Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/849
JAPAN
February 1964
Submitted in: ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

HAZARD EVALUATION OF RADIOACTIVE CONTAMINATION OF SEA AND DECONTAMINATION OF RADIOACTIVITY IN FRESH WATER

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Part 1. Hazard Evaluation of Radioactive Contamination of Sea (by Y. Hiyama)

The author has been working on the experimental analysis of the quantitative relation in the levels of radioactive contamination between sea water and organisms since several years, three years of this period being sponsored by the IAEA, on the elements thought to be important in the waste disposal problem, such as Cs, Sr, I, Co, Zn, Cd, Fe, Ru, and Ce.

As a result of this series of numerous rearing experiments in the laboratory, it was possible to know the level of the concentration of a certain radionuclide in a certain tissue of an organism by knowing the concentration of it in the sea water and how long it has been in that environment.

The concentration factors, a ratio of the concentration of an element in a tissue of an organism to that of sea water, were obtained during the rearing experiments in tanks. The equilibrium value of the concentration factor differs greatly according to the systematical position of the organisms, and the rate of uptake differs according to the stage of growth of organisms and the temperature of the water.

The equilibrium values of the concentration factor obtained by this series of experiments were compared with those which were obtained by chemical analysis of the stable and radioactive elements by previous workers. There are some differences between the two results, and considerations were made on the reason of it.

Finally, a way to control and to monitor the radioactive contamination of the sea is described.

Part 2. Decontamination of Radioactivity in Fresh Water
(by M. Saiki et al.)

From the viewpoint of radiological safety, contamination of fresh water by radioactive effluents and fallout has become a serious problem in recent years. Since fresh water is a basic necessity of man, the studies in this paper are based on our experiments on the relationship of radioactivity among water sources (river water, etc.), service water (drinking, etc.) and sewage, environmental behavior of radionuclides, and the various aspects of radiological decontamination.

1. Behavior and Concentrations of Cs-137 and Sr-90 in Fresh Water in Japan

The concentrations of Sr-90 and Cs-137 in river and service water collected by 24 Prefectural Institutes of Public Health, located throughout Japan, were determined monthly during the period 1961 to 1963.

a. Concentrations of Sr-90 and Cs-137 in river water ranged between 0.1 - 1.3 pc/l and 0.0 - 1.0 pc/l, respectively.

b. During the above period, the level of Sr-90 and Cs-137 concentrations originating from fallout showed their highest peaks in May and June of each year, which were the same as the peaks in the seasonal variations of rainfall.

c. The concentrations of Sr-90 and Cs-137 in the water sources decreased in the following order: surface water > submerged ground water > ground water.

d. The average value of the Sr-90 concentration in the service water was 80% of the amount found in the water source. The ratio of Cs-137/Sr-90 in the water source and the service water were 0.52 and 0.27, respectively.

e. The results shown in paras. c and d reveal that the Cs-137 in the source water was effectively removed during the purification process. It was also observed that Cs-137 was easily precipitated on the river bed with sediment, while the Sr-90 moved with the water.

2. The Relation of Radioactivity between Air and Sewage

The estimation of environmental contamination levels and decontamination effectiveness concerning a sewage treatment plant were studied. Our observations on the concentrations of Zr-95-Nb-95, Ru-103, Ru-106-Rh-106, Ce-141 and Ce-144 in rain water and sewage in the Tokyo area indicated that up to thirty per cent of the total radionuclides which fell over the drain area arrived at the sewage treatment plant with the rain water. The total amount, however, depended on the weather conditions during the rain fall. It should be noted that almost all the radioactive substances which entered the sewage treatment plant were adsorbed effectively on the active sludge during the treatment process.

3. Radioactivity Decontamination Materials for Drinking Water

Inhabitants living in remote areas or on the separated islands of Japan depend on rain water for drinking purposes. Therefore, a simple filter to remove radioactivity in rain water is required, especially in cases of nuclear accidents. The capability of removing Sr-90, Cs-137 and I-131 from rain water by ion-exchange resin, vermiculite, calcinated vermiculite, active carbon and various types of charcoal and sea sand were tested.